DESCRIPTION

# ELECTRIC CONNECTOR FOR BOARDS, METHOD FOR FORMING HOUSING OF ELECTRIC CONNECTOR FOR BOARDS, AND METAL MOLD OF INJECTION MOLDING FOR FORMING ELECTRIC CONNECTOR FOR BOARDS

## Technical Field:

This invention relates to an electric connector for boards, fixed to a surface of a circuit board.

## Background Art:

In recent years, the spread of personal computers has been remarkable. In a personal computer, a pair of electric connectors used for the board-to-board connection, and a pair of electric connectors used for the wire-to-board connection are provided.

For example, an electric connector fixed to an outer surface of a power board which controls a power source and an electric connector fixed to a mother board on which a CPU is mounted are connected together. One electric connector is a plug type connector having a connecting projection, while the other electric connector is a receptacle type connector having a connecting recess.

Conventionally, as a receptacle type electric connector of this kind (as disclosed in, for example, JP-A-11-067364), an electric connector having terminal retainer recesses opened

in the connector-joining direction and formed in each of a pair of side walls which define a connecting recess has heretofore been provided.

With demands for the miniaturization and a higher function of a personal computer body, the electric connector of this kind has also demanded the miniaturization thereof and an increase in the number of electrodes thereof.

In general, the depth of the terminal retainer recesses between the electric connectors of this kind is set to 12 to 13 mm. In the meantime, it is demanded that the width of each of the terminal retainer recesses be set to, for example, around 0.4 mm, and that the intervals (pitch) at which the terminal retainer recesses are arranged be set to, for example, around 0.6 mm. In this electric connector, it is necessary that the thickness of each partition wall between adjacent terminal retainer recesses be set to, for example, as extremely small as 0.1 mm.

Therefore, in order to meet these demands in the connector disclosed in the above-mentioned JP-A-11-067364, the following new problems arise.

In a metal mold for molding a housing, it is necessary that terminal retaining recess-molding ribs be made thin (for example, 0.4 mm), and that the intervals of the ribs be set small (for example, 0.6 mm). However, when the terminal retainer recess-forming ribs are thus formed, there is a fear of deforming

the ribs due to the pressure occurring during an injection molding operation. When the ribs are deformed during an injection molding operation, the thin partition walls (having a thickness of, for example, 0.1 mm) between the terminal retainer recesses are also deformed. In addition, the position accuracy of the terminal retainer recesses is deteriorated, and in its turn the position accuracy of the terminals decreases. As a result, the reliability of the electrical connection of the connectors lowers.

Disclosure of the Invention

The present invention has been made in view of these problems, and aims at providing a miniaturized, highly reliable, electric connector for boards, capable of heightening the position accuracy of the terminals arranged at small intervals.

In order to attain this object, the present invention provides an electric connector for boards, including a housing of an insulating synthetic resin having a connecting recess opened in the connecting direction, and a plurality of terminals retained side by side by the housing, the housing including a pair of opposed side walls extending laterally so as to define the connecting recess therebetween, terminal retainer recesses penetrating through the respective side walls in the connecting direction, partition walls provided between adjacent terminal retainer recesses, and a plurality of openings formed in the portions of each of the partition walls, each opening corresponds

to each partition wall, each opening making open to the exterior a pair of terminal retainer recesses opposed to each other via the partition wall opposed to the corresponding opening.

According to the present invention, pins for forming the openings in the outer side surface of the partition walls when the housing is injection molded in a metal mold are interposed between the adjacent terminal retainer recess-forming ribs in the metal mold. Therefore, during the injection molding operation, the deformation of the terminal retainer recess-forming ribs is held down, so that the position accuracy of the terminal retainer recesses (i.e. partition walls) arranged at small regular intervals can be heightened. In its return, a miniaturized, highly reliable, electric connector having a high position accuracy of the terminals can be provided.

It is preferable that the openings in the outer side surface of the side wall be provided generally in an intermediate portion in the direction of the height of the side wall for the purpose of reliably suppressing the deformation of the terminal retainer recess-forming ribs during the injection molding operation.

Brief description of the drawings:

Fig. 1A is a plan view of the electric connector of a mode of embodiment of the present invention, and Fig. 1B a side view thereof;

Fig. 2 is a sectional view taken along the line II-II

in Fig. 1B;

Fig. 3 is a sectional view taken along the line III-III in Fig. 1B;

Fig. 4 is a schematic sectional view of the electric connector connected to an opposed plug type electric connector;

Fig. 5 is a partially cutaway view in enlarged perspective of a side wall of the electric connector; and

Fig. 6 is a schematic perspective view showing the construction of a metal mold.

Note that in the drawings, 1 denotes a (receptacle type) electric connector (electric connector for boards), 2 a circuit board, 2a an outer surface, 3 a housing, 3a a counter-surface, 4 and 5 terminals (for signals), 6 terminals (for a power source), 11 (plug type) electric connector, 12 a connecting projection, 13 a connecting recess, 14 and 15 side walls, 14a and 15a connecting-side end surfaces, 14b and 15b outer surfaces, 18 terminal retainer recesses, 19 a main body portion, 20 an elastically bent portion, 21 a projecting portion, 22 a contact, 23 a contact end portion, 25 openings, 26 partition walls, 30 a metal mold, 31 opening-forming pins, 32 terminal retainer recess-forming ribs, 40 opened portions, X a lateral direction, Y a connecting direction (a direction of the height), and Z a direction opposite to (the connecting direction).

Best Mode for Carrying Out the Invention:

A preferred mode of embodiment of the present invention will now be described with reference to the attached drawings.

Fig. 1A and Fig. 1B are plan view and a side view of a mode of embodiment of the electric connector for boards according to the present invention, Fig. 2 a sectional view taken along the line II-II in Fig. 1B, and Fig. 3 a sectional view taken along the line III-III in Fig. 1B.

This electric connector 1 is a receptacle type electric connector. This mode of embodiment will be described on the basis of a case where the electric connector is used as one of a pair of board-to-board connecting electric connectors as shown in Fig. 4. This electric connector 1 can also be used as one of a pair of wire-to-board connecting electric connectors.

Referring to Fig. 2, the electric connector 1 is provided with a housing 3 fixed to a surface 2a of a circuit board 2 and made of an insulating synthetic resin, and a plurality of terminals for signals 4, 5 arranged in two lateral rows so that the terminals 4, 5 penetrate through the housing 3. Referring to Fig. 3, the electric connector 1 is provided with terminals 6 for a power source, arranged in two lateral rows so that the terminals 6 extend through the housing 3.

Referring to Fig. 1A and Fig. 1B, the housing 3 is long in the lateral direction X. Referring to Fig. 1B, the

housing 3 has a counter-surface 3a opposed to the surface 2a of the circuit board 2 when the housing is fixed to the circuit board 2. The end portions opposed to each other in the lateral direction X of this counter-surface 3a are formed as a pair of fixing portions 7, 7 to be fixed to the surface 2a of the circuit board 2.

On the counter-surface 3a, an intermediate portion 8 between the two fixing portions 7, 7 is in a position offset upward from the fixing portions 7, and a clearance of a predetermined height is provided between the intermediate portion 8 and the surface 2a of the circuit board 2. Referring to Fig. 1A and Fig. B and Fig. 2, the leads 4a, 5a of the terminals 4, 5 project from the intermediate portion 8, extend sideways, and are soldered (not shown) to the surface 2a of the circuit board 2.

In the meantime, the leads 6a of the terminals 6 are held in the corresponding terminal retainer recesses 50 as shown in Fig. 3. As shown in Fig. 1A and Fig. 1B and Fig. 3, the leads 6a of the terminals 6 extend outward from side holes of the fixing portions 7, 7, and are soldered to conductive portions of the surface 2a of the circuit board 2.

As shown in Fig. 1B, a pair of locking members 9, 10 formed out of a synthetic resin integral with the housing 3 project in a boss-like state from the two fixing portions 7, 7. The locking members 9, 10 extend through corresponding locking recesses 2b, 2c in the circuit board 2 and locked therein

as shown in Fig. 2 or Fig. 3. Each of the locking members 9, 10 are formed, for example, so as to have different diameter portions for thereby preventing the locking members from being fixed reversely to the circuit board 2.

Referring to Fig. 1A and Fig. 1B, the electric connector 1 is of a so-called top type, and the housing 3 thereof has the connecting recess 13 for inserting therein and connected thereto the connecting projection 12 of the plug type electric connector 11 shown in Fig. 4 and paired with the connector 1. The connecting recess 13 is opened in the connecting direction Y of the electric connector 1. The plug type electric connector 11 is of a so-called side type fixed to the opposed circuit board 60, and extending at its connecting projection 12 in parallel with the circuit board 60. However, the plug type electric connector 11 may also be of a so-called top type. Referring to Fig. 4, to the terminal 5 in a connected state, the terminal 70 opposed thereto of the plug type electric connector 11 is connected.

Referring to Fig. 1A, the connecting recess 12 is defined by a pair of opposed side walls 14, 15 and a pair of opposed end walls 16, 17, all of which are provided in the housing 3, and has a rectangular shape.

Referring to Fig. 2, each of the side walls 14, 15 is provided with a plurality of terminal retainer recesses 18 arranged side by side (in the lateral direction X in Fig. 1) and penetrating through the side walls 14, 15 in the connecting

direction Y.

The terminal retainer recesses 18 are opened in the connecting side end surfaces 14a, 15a, and extend in the direction Z contrary to the connecting direction Y, the retainer recesses 18 being thereby opened in the above-mentioned counter surface 3a as well.

Referring to Fig. 2, the terminal 4 is provided with an elongated main body 19 press-fitted and locked in a terminal retainer recess 18, a projecting portion 21 extending from an upper end of the main body 19 via an S-shaped elastically bent portion 20 in the connecting direction Y, a contact 22 made of a mountain-shaped projection formed in the projecting portion 21, a contact end portion 23 extending diagonally from the contact 22, and a lead 4a extending outward in a bent state from a lower end of the main body 19.

The terminal retainer recess 18 is opened to the connecting recess 13 through the opened portion 40. Since the projecting portion 21 is elastically urged toward the connecting recess 13 by the elastically bent portion 20, the contact 22 enters the interior of the connecting recess 13 through the opened portion 40. Since the contact end portion 23 engages a stopper 24 provided on an end portion of the corresponding side wall 14, the quantity of projection of the contact 22 toward the connecting recess 13 is restricted.

As shown in Fig. 4, the terminal 5 also has the same construction as the terminal 4.

Referring to Fig. 1B and Fig. 2, the outer side surfaces 14b, 15b of the side walls 14, 15, a plurality of vertically long openings 25 are formed side by side (in a row in the lateral direction X). The opening 25 is provided generally in an intermediate portion in the direction of the height (i.e. in the connecting direction Y) of each of the side walls 14, 15.

The side wall 14 and the side wall 15 have the same construction. The side wall 14 has partition walls 26 separating the adjacent terminal retainer recesses 18 from each other. The openings 25 are formed in the outer side surface 14b of the side wall, and the openings 25 are opposed to the relative partition walls 26. Further, the openings 25 are formed by cutting out the parts of the side wall. The opening communicates with the terminal retainer recesses 18 on both sides via a pair of communication portions 25a (in Fig, 5, one communication portion 25a only is shown). As a result, each opening 25 makes a pair of terminal retainer recesses 18, 18 open to the exterior of the housing 3 respectively, wherein the pair of terminal retainer recesses 18, 18 are opposed to each other via the partition walls 26 opposed to the opening 25.

Fig. 6 is a schematic drawing showing the part of a metal mold which is used to injection mold the portion shown in Fig. 5 of the housing 3. In the metal mold 30, pins 31 for forming the openings 25 are interposed among the ribs 32 of the metal mold 30 for forming the adjacent terminal retainer recesses during an injection molding operation. Therefore,

the deformation of the ribs 32 for forming the terminal retainer holes during an injection molding operation is held down. This enables the position accuracy of the terminal retainer recesses 18 arranged at small intervals and partition walls 26 to be heightened, and in its turn the position accuracy of the terminals 4, 5 to be also heightened. Thus, a miniaturized, highly reliable, electric connector 1 can be provided.

Especially, since the openings 25 are provided in the portions of the side walls 14, 15 which generally correspond to intermediate sections in the direction of the height (i.e. in the connecting direction Y) of each of the side wall 14, 15, the deformation of the ribs 32 for forming the terminal retainer holes during an injection molding operation can be reliably prevented.

The present invention is not limited to the above-described mode of embodiment but can be modified variously within the scope thereof.

Industrial Applicability:

When the housing is injection molded in the metal mold in the present invention, the pins for forming the openings in the outer side surface of the partition walls come to be interposed among the ribs of the metal mold for forming the adjacent terminal retainer recesses. Therefore, since the deformation of the terminal retainer recess-forming ribs can be held down during an injection molding operation, the position

accuracy of the terminal retainer recesses (partition walls) arranged at small intervals can be heightened, and in its turn the position accuracy of the terminals can also be heightened. This enables a miniaturized, highly reliable, electric connector to be provided.